Notebook Series -- Notebooks by Experimenters Other Than Edison
Navy and Wartime Research Experiments -- Miscellaneous Books
Notebook N-17-02-11

This notebook was used by Edwin Smith, Jr., during February-July 1917 for notes on experimental work done for the U.S. Navy. The experiments at the beginning of the book, which were directed by Edison, pertain to efforts to prevent the guns on submarines from rusting because of the salt water. Some of the subsequent entries relate to efforts, directed by Edison, to find a substance to place on the lenses of range finders and spotting telescopes to prevent spotting due to undried salts from sea water spray. Other entries concern the development of a respirator to protect men in the fighting tops of battleships from sulfur dioxide fumes, as well as a smoke bomb and a primary battery for airplane use. The front cover is labeled "T.A.E. Personal 'X' Account #5045. 2-11-17 -- #5049 2-19-17" and "Edwin Smith Jr." The pages are unnumbered. Approximately 150 pages have been used.

N-17-02-11

69593
Acme Co.,
MFG. STATIONERS,
66 JOHN ST.
AND
19 PLATT ST.
NEW YORK.

5016 sigath
5009 fumes

N-17-02-11

(Edwin Smith, Jr.)

(X) Experiment finished

#5045 - 2-11-17

Prevent the rusting and pitting of the gun on Submarine (by use of some other metal) or by other means

When the vessel is submerged a stopper is placed in the muzzle of gun and another in the breech. Rusting and local pitting occurs on gun which is subjected to the action of the seawater.

When returning on the surface the deck is practically a wash and gun is covered with spray which on evaporating leaves a deposit of salt. Local pitting occurs thereon.

For the submerged condition Mr. E. thinks the use of a zinc plate forming an electro couple with the gun steel will be sufficient to prevent decomposition of the amount generated in not so strong as to decompose the $MgSO_4$ present in water.

(1)

(X) #1

2-11-17. A piece of Zn (111.4459) and a piece of soft steel both polished (212.9740) were connected by an iron wire and suspended in a jar of sea water from Sandy Hook.

A crucible another piece of steel (218.1409) was hung in another jar of sea water.

All three were polished.

2-17-17 10:00 a.m. single piece had been attached with formation of ferricoxide. Steel in the crucible was coated with a deposit of MgO

While writing the above it occured to me that this was all that would be necessary to protect the steel when above water and subject to the action of the spray. (see further on)

#2 A second experiment was made this morning. The same piece of Zinc was used and a large piece of steel was polished and two pieces 3½" long cut from it. Steel No 2 (183.7209) was

#2

connected with the Zinc and Steel No 1 (155.0159) hung freely in same sea water in a separate battery jar, 11:10 a.m 2-12-17

Water changed 11:05 a.m 2-13-17

Not had been attached with liberation of flocculent Fe_2O_3 No 2 had a granting of $(Mg(OH)_2)$ ZnO deposited on it.

1:30 p.m 2-13-17 The fresh sea water has not effected ~~the~~ No 1. The wire supporting it was bent over a stick and touching the water on the other side. Was bent up out of the water.

Water changed 9:00 a.m 2-15-17 - #1 rusty

" " 9:00 a.m 2-17-17 - #1 rusty

" " 9:50 p.m 2-26-17 - Pulled out

2 in. [illegible] Red rust removed off one side surface bright underneath

Replaced coupled to 2 inc 9:30 a.m. 3-9-17.

In protecting the steel surface that comes in some contact with and subject to the action of the salts, we proposed to coat the metal in some way.

An alkaline paint of some sort is needed or else a metallic paint that will set up a counter E.M.F.

M.G. proposed Zn. Sn. MgO etc. The problem of a carrier must be solved by something that is not acid.

Cotton seed oil is given as having no free acid but is not a drying oil.

W.G. Scott in "Paints and Painting Materials" (WP+PM) page 31 states that the best protective coatings are mixtures containing Wax varnishes free from rosin and oils containing little or no mucilaginous material.

A long series of tests made on Grain showed that under the conditions (1) Wax Oil (Carbon wax in 1 gal boiled oil) gave absolutely no rust condition good.
(2) Red Lead in oil transport
(3) American Vermilion in oil, no rust

Magnesia in linseed oil will darken with exposure to air and boiling.

(Coat the metal with a quick air that will prevent air access the Mg (OH)2)

MgO [illegible] be used for [illegible] the free acid from [illegible] Wax oil [illegible] Paint.

A carrier only a drying oil free from acid or a high m.p. wax dissolved in a volatile solvent.

Waxes		m.p. °F.
Ceresin	Yellow	140 - 173
"	White	145 - 210
Ozokerite		80 - 212
Paraffin wax		90 - 138

	MP °F	
Wax		
Petrolatum	95-122°	
Vaseline	85-115°	
Beeswax	140°-158°	8.0 to 11.0% acid

#3 (X) Electro Couples.

A stick of metallic Cadmium and a piece of Steel suspended in sea water at 10:00 P.M. - 2-12-17 showed slight corrosion any deposition of Fe_2O_3 by noon 12-13-17

N.G.

#4 (X)

A piece of tin foil and a piece of Steel suspended in sea water at 11:30 A.M. 2-13-17 showed effects of corrosion as indicated by the deposition of Iron oxide very quickly. At the end of 3 hours action was marked.

N.G.

Buff (5-6) - (7+8)

Paint.

#1 Zinc Dust in Boiled Linseed Oil
Thurs + Japan Drier
Position 1 on Steel #1 + I painted 8:30 P.M. 2-14-17
10:30 A.M. 2-15-17 dry good covering

#2 Zinc Dust in same
Position 2 on Steel #1 + I painted 8:31 P.M. 2-14-17
10:30 A.M. 2-15-17 Nearly dry good covering

#3 Zinc Dust in Raw Linseed oil + Drier
Position 5 Steels 1 + I Painted 8:30 P.M. 2-14-17
10:30 A.M. 2-15-17 - dry fair coat ~~with~~ quite transparent

#4 Zin Dust in Raw oil + Drier
Position 6 Steels 1 + I Painted 8:30 P.M. 2-14-17
10:30 A.M. 2-15-17 Nearly dry transparent

#5 Zinc Dust in Boiled Oil + Drier X
Not painted.

6 Zin Dust in Boiled oil and Drier - X
Not painted

#7 Zinc Dust in Petrolatum thinned with gasoline
Position 1 Steel 2 & II Painted 9:00 P.M. - 2-14-17
10:30 A.M. 2-15-17 quite good coat

#8 Zinc Dust in China Wood Oil.
8a drier added.
Position 1 Steel 3 + III Painted 9:30 P.M. 2-14-17
10:30 A.M. 2-15-17. dry fair cover.

#9 Zinc Dust in Shellac.
Position 6 Sheet 3 & III Painted 9:30 P.M. 2-14-17
10:30 A.M. 2-15-17 dry Zinc dust not well distributed
Shellac too thin to hold it

#10 Zinc Dust in Japan Drier

#11 Zinc Dust in Rosin Oil Japan Varnish & Turps
Position 4 Steels 2 & II Painted 9:00 P.M. 2-14-17
10:30 A.M. 2-15-17. Soft & sticky. Pulled away from the colors more on II than on 2.

#12 Zinc Dust in Menhaden Oil.
Position 7 Steels 2 & II Painted 9:00 P.M. 2-14-17
10:30 A.M. 2-15-17 dry good cover.

#13. MgO (140 mesh) in Raw linseed Oil + driver & turps
Position 7 Steels 1 & I Painted 8:30 P.M. 2-14-17
10:30 A.M. - 2-15-17 Nearly dry transparant

#14 MgO (140 mesh) + Zinc Dust in Raw Linseed Oil & turps
Position 8 Steels 1 & I Painted 8:30 P.M. - 2-14-17
10:30 A.M. - 2-15-17. Nearly dry good cover

15 Boiled Linseed Oil MgO (140 mesh) + turpe
Position 3 - Steels 1 & I painted 8:30 P.M. 2-14-17
10:30 A.M. 2-15-17 Nearly dry, transparent

16 Boiled Linseed Oil MgO (140 mesh) + Zinc Dust
+ turpe
Position 4 Steels 1 & I painted 8:30 P.M. 2-14-17
10:30 A.M. 2-15-17 - dry good covering retained in
supernatant oil.

17 Monohydrin Oil MgO (140 mesh + turpe
Position 8, Steels 2 + II Painted 9:00 P.M. 2-14-17
10:30 A.M. 2-15-17 Nearly dry transparent

18 Monohydrin Oil MgO (140 mesh) + Zinc Dust + turpe
Position 9 Steels 2 + II Painted 9:00 P.M. 2-14-17
10:30 A.M. 2-15-17 dry good cover.

#19 Rosin Oil + drier + MgO + turpe
Position 1. Steel 2 & II Painted 9:00 P.M. 2-14-17
10:30 A.M. 2-15-17. Soft + sticky pulled away from the edge a little, more on II than on 2.
Japan drier does not appear to have dissolved in oil well

#20 Rosin Oil + drier + MgO + Zinc Dust + turpe
Position 6. Steel 2 & II Painted 9:00 P.M. 2-14-17
10:30 A.M. 2-15-17 - Nearly dry good cover!

#21 Petrolatum in gasoline MgO
Position 2 Steel 2 & II Painted 9:00 P.M. 2-14-17
10:30 A.M. 2-15-17. greasy good cover

#22 Petrolatum in gasoline MgO + Zinc Dust
Position 3 Steel 2 & II Painted 9:00 P.M. 2-14-17
10:30 A.M. 2-15-17. greasy good cover

#23 Raw Linseed Oil Driers MgO & Zinc Dust
Position 4 Sheet 1 & I Painted 8:30 P.M. 2-14-17
10:30 a.m. 2-15-17 Nearly dry good cover.

24 China Wood oil Turp MgO
Position 2. Sheet 3 + III Painted 9:30 - 2-14-17
10:30 a.m. 2-15-17. Surface had cracked and fusted all over Washed off with Acetone & Ether afterwards about 9:00 a.m. and painted again

Painted 9:30 P.M. 2-14-17
removed 10:30 a.m. 2-15-17

#25 China Wood Oil Turp MgO + Zn.
Position 3 - Sheet 3 + III dry. large lot of small surface cracks and ~~B~~ had partially fused washed off as in the case of No 24 and applied another coat

26. Neatsfoot oil Dryer Turp MgO
Position 4. Sheet 3 + III Painted 9:30 P.M. 2-14-17
10:30 a.m. 2-15-17 Not drying well transparent

C23

#27 Neats foot oil Dryer turpe MgO + Zn
Position 5 - Steels 3 + III Painted 9:30 P.M. 2-14-17
10:30 A.M. 2-15-17. Not drying at all fair
covering

#28 Cozza Oil dry turpe MgO
Position 7, Steels 3 + III Painted 9:30 P.M. 2-14-17
10:30 A.M. 2-15-17 Not yet dry transparant

29 Cozza Oil dry turpe MgO Zn.
Position 8 - Steels 3 + III Painted 9:30 P.M. 2-14-17
10:30 A.M. 2-15-17 - Not yet dry fair covering

30 Oil of Sesame dryer turpe MgO

#31 Sesame Oil dried & tarp MgO + Z-n
Panthar 9- Steel 3 + III Painted 9:30 P.M. 2-14-17
10:30 A.M. 2-15-17- Not yet dry fair covering power.

Eff. 5 + 6
2 pieces of polished steel painted crosswise starting at bottom with following
#1, #2 #3, #4, #5, #6 points

	#5	#6
Starting in sea water	9:00 A.M. 2-14	9:00 P - 2-14
out	9:00 P.M. - 2-14	9:00 A - 2-15
in	9:00 A. - 2-15	8:30 A - 2-16
out	8.30 A - 2-16	9:30 - 2-17
in	5:00 P - 2-16	
out		
in		

July 9-1917
Surface film but with no 3 paint on both plates
Eff 6 was out of the water lying in a damp atmosphere the last 2 months ~~Not film~~ Paint No. 3 has given a good film on it.

After rubbing the bottom with a cloth to see how the film stand up placed in a bottle of fresh sea water with tag having particulars on it

Special Alloys Feb 15-1917

Received the following alloys from Mr Edison late last night (10:30 P.M.) to be tested out to see how they stand up in Sea Water.

#1 "Norway Iron" 5 pieces about 3" long each of bar 1 1/8" x 3/16 1 piece 2" x 1 1/8 x 3/32?
Marked the 2 pieces to be polished with 1 file nick.

#2 "Armco Plates" "Hasbean in Acid"
3 pieces 3 3/4" x 6 1/4 x 1/16
Marked the 2 pieces to be polished with 2 file nicks

#3 "Copper Steel Deoxidized" 3 pieces just 4 1/4 x 1/16 (3/32)? 2 pieces 5 1/2 x 4 (1/32)?
Marked the 2 pieces to be polished with 3 file nicks.

#4. "Toucan Metal." 3 sheets 5 x 4 3/8 x 1/32
Marked the 2 pieces to be polished with 4 file nicks

#5 "Monel Metal" 3 sheets 5 1/4 x 4 3/4 x 1/32
Marked the 2 pieces to be polished with 5 file nicks

Gave the 10 pieces to be polished to George Ott 9:00 a.m. 2-15-17. No time given as to when I could get them

Placed these in the afternoon cut them up. Placed these in the battery jar with Sea Water about 7:30 P.M.

Experiments run as follows.
file nicks on the bottom as follows

Eff 9	1 nick	Eff 11	3 nicks
Eff 10	2 nicks	Eff 12	4 nicks

file nicks also indicate industry metals according to scheme on opposite page.

#9 In sea water in comparison with steel
#10 Coupled to zinc in Sea water in comparison with steel
#11 In sea water overnight including alloy in comparison with steel
#12 Coupled to zinc in sea water overnight including alloy in comparison with steel

Steel taken out See Eff. # 45

Note numbers in ( )

	#9	#10	#11	#12
In	9:31 P.M. - 2-15	9:31 P.M. 2-15	9:30 P.M. 2-15 (1)	9:30 P.M. - 2-15
out			9:00 a - 2-16	9:00 a - 2-16
in		all rusted except metal metal	10:20 a - 2-16	10:20 a - 2-16
out			11:50 a - 2-16	11:50 a - 2-16
In			2:40 p "	2:40 p "
out			3:55 p "	3:55 p "
In			5:00 p "	5:00 p "
out			9:30 a 2-17	9:30 a 2-17
In			"	"

out July 6 all ~~bound~~ with rust. Surface of all except Monel Metal corroded - 5 Months

Note.

(1) Eff 9 + 11 Water rusty in Eff 11 Steel Housing from Armcoplate, Toucan Metal Copper steel hard metal in order named. Only the lower parts.

Eff 10 + 12 Metals are coated with white clo paint and do not appear to be acted on.

7-6-17

~~7-6-17~~

#9 - all Rusted

#10 - all Rusted except No 6 which is clear

#11 all rusted

#12 all rusted except No 5

Feb 15 1917

Try to find an electrolyte which will dissolve iron but it not decomposed by Zinc. Then put Zinc in it and the action of the galvanic couple formed by Zn-Fe would decompose the water and plate the Iron.

In the way water of Zinc might be caused to decompose + deposite Zinc on the iron by some sort of an electrolytic than Zinc.

+ Cesium		Bismuth	− 0.50
Rubidium		Arsenic	− 0.55
Potassium		Copper	− 0.59
Sodium		Mercury	− 1.03
Magnesium	+ 1.24	Silver	− 1.06
Aluminum	+ 1.03	Palladium	− 1.07
Manganese	+ 0.82	Platinum	− 1.14
Zinc	+ 0.51	Gold	− 1.36
Cadmium	+ 0.16		
Cobalt	+ 0.11	Fluorine	—
Iron	+ 0.09		
Cobalt	− 0.02		
Nickel	− 0.02		
Tin	− 0.09		
Lead	− 0.10		
Hydrogen	− 0.25		
Antimony	− 0.83		

Action of Zinc on following salts

	Cold	Hot
Nickel Amm. Sulphate	no action	
Nickel Sulphate	little or no action	decomposes
Cadmium Amm. Sulphate	decomposes	
Cadmium Sulphate	No Action	none
Ammonium Chloride	decomposes	
Chrome Alum	No Action	slow decomp.
Manganese Sulphate	No Action	slow decomp.
Potassium Sulfate	No Action	none

Action of Magnesium on following salts

		Cold	Hot
Zinc	Am Sulfate	Slight	decomposes
Zinc	Chloride	decomposes	

Experiment 7 + 8

Six pieces of polished steel Marked 1, 2, 3 & I, II, III,
1, 2, 3 are the best metal surfaces.
Painted in cross wise strip about 3/4" wide starting at bottom

Position	1 + I	2 + II	3 + III
1	1	7	8
2	2	21	24
3	15	22	25
4	16	11	26
5	3	19	27
6	4	20	9
7	13	12	28
8	14	17	29
9	23	18	31

Figures refer to off page.
(2) Water rusty both Exp. Exp 7 all injured condition except Paint 24 + 25 which have mixed up same remarks applies to Exp 8
(5) Water changed in both test 4:00 P.M. 2-16

Experiment #7 + 8

Painted 9:30 P.M. 2-14-17
dried until 8:00 P.M. 2-15-17

	Note	#7	#8
In water	1	8:00 P.M. 2-15	8:00 P 2-15
out	2	9:00 a 2-16	
In	3	11 45 a 2-16	
out	4	1 10 P 2-16	
In	5	water changed 5:00 P 2-16	
out	6	9:30 a 2-17	
In	7		
	8		
	9		
	10		
	11		
	12		
	13		
	14		
	15		
	16		
	17		
	18		
	19		
	20		
	21		
	22		
	23		
	24		

Experiment #7 & #8

#7 taken out 2:00 P.M. 3-27-17 40 days

intermittent exposure to sea water

Plate 1 Position	Resistance to rubbing	Value
1	fair	10
2	good	8
3	poor	10
4	fair	10
5	good	10
6	"	9
7	"	10
8	"	10
9	"	10
Plate 2.		
1	poor	4
2	"	4
3	"	5-
4	good	9
5	"	10
6	"	10
7	fair	10
8	poor	10
9	"	10
Plate 3		
1	Film no	3
2	"	5-
3	"	7

Experiment 7 + 8

4	not dry	9
5	" "	9
6	no ag	0
7	not dry	10
8	" "	10
9	" "	10

Experiment 7 + 8

Plate I II & III taken out July 6—1917

140 day. 4 Months 20 days 20 weeks

Plate I Position bottom to top	Resistance to rubbing	value as protection
1	~~good~~	8
2	good	6
3	good	7
4	good	9+
5	"	9+
6	"	8
7	"	9
8	"	10
9	"	8
Plate II		
1	surface rubs off but leaves a hard coating of zinc that is difficult to get off	4
2		2
3		5-
4	sticky poor	9+
5	" "	9

	sticky	poor	9+
4		"	9
7		"	5-
8		"	9+
9			
Plate III			
1	neg	poor	2
2	"	"	2
3	"	"	0
4	sticky	poor	10
5	"	"	10
6		good	10
7	sticky	notchy	9+
8	"	"	10
9	"	"	10

Electrolyte $ZnCl_2$ + Mg Powder

N.G.

(X) Exp. 13. 2-16-17

Steel plate wet with $ZnCl_2$ and then rubbed with Mg. Powder. ~~Then side rinsed~~ with hot tap water. Other side rinsed and rubbed clean. Both sides attached at end of ~~two~~ 2 hours.

(X) Exp. 14 - 2-16-17

Steel treated the same way using Zinc ~~Sulfate~~ Sulphate. Both sides rinsed at end of 2 hrs.

(X) Exp. 24 2-16-17 Repeat of No. 13 using same plate after careful cleaning and polishing both sides with brown cloth. Carefully wet to touch polished surface with the finger. Concentrated $ZnCl_2$ (in cold) put on plate then ~~rubbed~~ with piece of cloth on which was some Mg powder. Reaction indicated by the bubbles taking place.

Placed in Sea Water 4:30 P.M.

Red placement matter all over 9:00 A.M. - 2-17-17.

By 5:00 P.M. - 2-19 The water had cleared, same and the part of plate in air badly rusted. Part under water O.K. with a fine black gray deposit rinsed off & changed water.

N.G.

Rubbing with Zinc dust alone

#15 Cold-rubbed with Zn dust unpolished surface 2-14-17 - placed in bay water 9:00 a.m. badly rusted 9:00 P.m.

#16 2-16-17 Cleaned above plate and rubbed with zinc dust on the unpolished surface Began to rust with in 2 hours

#17 Rough ground surface of another piece of steel rubbed with zinc dust and piece of leather. In water 9:30 a.m. 2-16-17 Out at 1:10 (3½ hrs) Settles - no rust see no 18

#18 (2-16-17) On the ~~other~~ end of same piece of steel (#17) rubbed both the rough and the smooth side with zinc dust, red flocs. 9:00 a.m. 2-17 N.G.

#25 (2-16-17) No 16 plate rinsed off in water and ~~did~~ (2.2) N.C.C. The flock that was in the liquid in #16 ~~than~~ last it polish. Zinc dust was rubbed in well and all but the upper ½ inch submerged in sea water 4:55 P.m. Red floc all over 9:00 a.m. 2-17

(41)

Amalgamation

~~Feb~~ Feb 15 - 1917 made up some Sodium Zinc Amalgam and some Sodium Cadmium Amalgam.

Sp/ No 20 - (2-16-17) Rubbed a piece of steel with Sodium Zinc Amalgam. Rubbed one side until shiny amalgam surface gone. The other side was left shiny in water at 11:00 a.m - Out 1:00 P.m (2 hrs) both sides attached

~~Sp~~ No 21 (2-16-17) Rubbed a piece of steel with Sodium Cadmium Amalgam which did not coat the metal nearly so easily as the Zinc. In sun water 11:20 a.m out 1:10 P.m (2 hrs) Badly attached

Sp 22 ~~Steel~~ (2-16-17) Steel wool in Na 2 cleaned & polished off with emery cloth coated well with Na Zn Amalgam - heated over flame to drive off Hg. not much success. After cooling the flame had discolored part of the metal and not all the Hg had been driven off. floated in sun water 4:35 P.m (2-16)

Red flocs 9:00 a.m - 2-17-17

N. G.

(2-16-17)
#23- Clean fine polished steel
Coated on one side with Na Zn amalgam
left shiny. Laid flat in table with amalgam-
ated side up and left covered with distilled
water for a long time then rinsed off
wiped dry and about 10 cc Sea water placed
on surface 3:30 P.M.
9:00 A.M. 2-17-17 Red spot surrounded by
a white ring of crystalline material
Let stand in room a while

Feb 16-1917 9:00 P.M.
Physician said that if the steel ~~is~~
~~also~~ coupled to Zinc it allowed to
stay under sea water for a time and
then rinsed with fresh water before
drying that the deposit appeared to be
MgO (Impossible that that is the constitution
as Mg is also deposited to Zinc) can
be rubbed down but not entirely
taken off and that then the steel will
be stable in Sea water.

#26 is a Zinc-Steel couple that has
stood in sea water since 4:05 P.M. 2-
13-17 with no change of water. There is a
sediment in bottom of jar as well as a heavy
deposit on this tile taken out 9:15 P.M.
(2-16-17) rinsed with distilled water and
dried. Sanded a small spot on the coating and
tested it. Found it was not MgO but
ZnO, The coating on this piece of
steel is too heavy to do any thing with.
Tomorrow take piece of steel dip for 1 or 2
minutes in a boiling 10% NaOH Solution Rinse Scour
~~with moistened Pumice powder if it can~~
~~be obtained, if not with scouring~~ then
dip in cold 10% HCl for 1 minute Rinse
[45]

thoroly and put in sea water coupled to Zinc plate. Call it ~~Zinc~~ Spp 27

~~Nos~~ 27 - 30 - 31 - 34 are in one jar started 10:30 a.m. 2-17-17

Nos 28-29-32-33 are in one jar started 10:15 a.m - 2-17-17

Nos 35-36-37-38 are in one jar started 3:40 P.m - 2-17-17

Nos 39-40-41-42-43 are in one jar started 4:50 P.m - 2-17-17

Nos 27-38 inclusive are coupled to Zinc.

Nos 39-43 inclusive are hanging free

Nos 37 & 38 are to be taken out when coated with ZnO. The Zinc ~~Coupled~~ taken off and the steel given hung in alone

#27 2-17-17 (1-inch)
Polished plate used in a previous experiment. Boiled in Caustic Soda (10% soln) rinsed dipped in 10% HCl for a minute washed free of acid and compared to Zinc
Taken out 9:00 a.m. - 2-19-17 washed dried and placed in sea water without zinc.
9:30 a.m. - 2-19-17 By 5:00 P.M. some rusting has developed. Rubbed off and replaced with zinc
9:30 P.M. - 3-5 9:00 a 3-8 good coating on nickel - shift to Zinc. turned plate around replaced with zinc

#34. 2-17-17 ⊕
Part of an old file grease dissolved off with Solvent Naphtha & Acetone
Compared to Zinc
9:30 P.M. 2-17 Compared and put same 3-17-17
Came out all together

#27 took Zn out 4:00 P.M. 3-12-17
9:30 a.m. 3-14 (40 hrs) slight amount of red rust forming on lower corner.

#43 - 2-17-17
Polished plate used in Exp. No. 26 Deposit of Zn O dissolved with weak HCl. Polished and thoroughly coated with No 7 paint (Petrolatum thinned with gasoline and a small % of zinc dust in suspension) - Gasoline allowed to evaporate. Left plate in sea water
OK. 5:00 P.M. 2-19-17 took out and dried replaced at 5:30 P.M. Placed out in air to dry again 9:30 back in water 10:15 P.M. 5:00 P.M. 2-24 (7 day) O.K.
10:30 a.m. - 3-9 - 19½ days rusted in spots took out Zinc coating does not rub off.

#44 ⊕ - 2-17-17
Piece of Zinc placed in sea water. 9:00 P.M.
5:30 P.M. - 2-19-17 Slightly oxidized

Sp. 28-29-30-31-32-33 (2-17-17)
All cut from a piece of cold rolled steel from stock room.
All coated with Zinc.

#28 (2 mins) Placed in water such as used with small amt. of acids and grease on it

#29 (3 mins) Filed to bright surface. One side with a coarse file. One side with a fine file. Put in water without further treatment.

#30 (4-mins) 133°C 3-17
Filed to bright surface like #29, then boiled in 10% soda, rinsed & placed in 10% HCl rinsed and put in water immediately
3-8-17 - 93°P.M. [illegible]
9:00 A.M. 3-8-17 - 60 hr rust forming, wiped off and replaced with Zinc 9:00 3/9 and in [illegible] dipped in HCl replaced without Zn. (N-G)

#31 (3-mins)
Material as used boiled in caustic rinsed and placed in HCl rinsed and immersed immediately
9:30 P.M. 3-8 [illegible]
9:30 A.M. 3-9 no rust forming
yet 4:00 P.M. 3-12 Took 2 in out
8:30 A.M. 3-14 (Holiday) OK entirely

#32 - 6-mins
Heated with strong HCl and allowed to hang in air until well rusted. Rinsed off and immersed in water

#33 7-mins
Heated in gas flame and quenched in water repeated 4 times immersed.

#33-34-37-38-39-40-41-42
2-17-17 - ~~4~~
Rusty plate from jinkle slightly pitted

35-36-37-38 coupled with 3mins
3:40 P.M.

39-40-41-42 Free. 4:50 P.M

#35 - 1-min
Material as rec'd no treatment

#36 – 2-niche
Material annealed boiled in caustic rinsed washed with HCl rinsed + immersed

37 – 3-niche
Material immersed as rec'd

#38 4-niche
Material annealed boiled in caustic rinsed washed with HCl & rinsed

#39 ⊕ 2-niche
Material as rec'd dipped in melted KHSO4 solution
9:00 a.m. - 2-19-17 – 40 minutes
rusty along edges
10:00 a.m. - 3-9-17 – 19 days badly rusted
not only along edges but also in square
too hard

⊕

#40 6-niche

Material boiled in caustic rinsed, washed in H2O rinsed dried dipped in Molten Petrolatum and immersed

Not Bondyzing ~~some~~ [illegible] place before stamped dipped in H2O immersion at 9:00 a.m. 2-19-17 rusted along edges. 19½ at 10 am 3-9-17 rusted too same upper as 39 took out

⊕

#41 - 7-niche

Material as usual coated with No 7 Paint (Petrolatum - gasoline & [illegible]) Bondyzing allowed to dry. Then immersed

9:00 a.m. 2-20-17 beginning to rust in spots along one edge in particular

5:00 P.m 2-24 - some rusting on one side

10:0 m 3-9-17 19½ days. badly rusted in spots all over took out

⊕

#42 8-niche

Material Boiled in caustic rinsed, washed in H2O rinsed dried and coated with #7 paint like #41

Note, Bondyzing some [illegible] to a high level before coating could be applied.

9:00 a.m. 2-20-17 beginning to rust in spots on both faces. 5:00 P.m - 2-24 same

10:00 a.m 3-9-17 badly rusted in spots all over surface, took out

⊕

#45 Steel coupled to Zinc in sep no 10 taken out 2 inc removed. Steel rinsed with distilled water and placed in fresh sea water (2-18-17) 11:00 a.m.

OK for several [illegible] the top edge of plate big [illegible] rusty [illegible] 5:00 P.M 2-19-17 took and washed [illegible] top rubbing off all rust and granular deposit, with fingers, then replaced in sea-water. Pushing in spots [illegible] 2-20 took out

#46 · 2-18-17

Piece of polished steel coupled to Zinc suspended in a solution of NaCl.

4:00 P.M.

9:00 A.M. 2-19-17 No deposit seems to have taken place. Used a coupling small piece of Zinc.

#47 - 2-19-17

Piece of polished steel put in a soln of $ZnCl_2$ in sea water @ 10:00 A.M.

#48 - 2-19-17.
Piece of steel fair polish left in HCl too long 9m afraid now has a dull surface. coupled with Zn and placed in Sea Water in which some $ZnCl_2$ is dissolved 10:30 P.M.

5:00 P.M. - 2-22-17 (67 hrs) dull coating took out washed & hung up to dry
Replaced in Sea Water alone 5:00 P.M 2-23-17
5:00 P.M. 2-24-17 O.K. except for one spot along top edge
10:00 a.m - 2-26 a little more rust on top edge otherwise O.K.
9:00 a.m. 3-8-17 - (13½ days 328 hrs) Still O.K. except for the small rough spot on the top edge
3:00 P.M 3-12-17 (430 hrs) Still O.K. as above.
8:30 P.M 3-13-17 OK as above changed to tank 9
8:30 a.m 3-14 OK as above (1172 hrs)

#49 - 2-19-17 11:00 P.M.
#35, 36, 37, 38 which not resting do not seem to have any deposit forming on them.
Placed a polished piece of steel coupled to Zinc in the same jar to see what happens.
9:30 a.m - 2-21-17 had a rather poor deposit. took out washed and placed in water alone
Rusted by 8:30 a.m 2-22-17.
Surface brushed off and rubbed with a cloth. Part of one side rubbed to shiny surface a little sea water placed on the flat surface body of 11:30 a.m. About 1:30 P.M found surface starting to rust. Shook off the water and [illegible] the rust rubbing
It appears to come from the the result of this and from general other that the chief rusting takes place where the material is continually wet by a thin film of water and the absorbed O_2 from the air has free play

C4L

#49 Wet the surface again + left to dry

(+)

#50 (a & b) 4:45 p.m. 2-19-17
Polished 2 plates Boiled in caustic rinsed washed in HCl, complied to Zon & put in water 4:45 P.M. 2-19-17
Fresh Sea Water 9:00 a.m. 2-20-17
8:30 a.m. - 2-21-17 (40 hrs) took out rinsed in fresh water + dried Replaced in alone in Sea water 9:0 a.m. By morning rust spots had disappeared.
9:00 a.m. - 2-22-17 took out
Treatment probably to along with HCl
H. G.

Rust stains appear through coating of dry hours.

51a ⊕

51 (a+b) 9:00 a.m - 2-20-17
Two pieces of steel polished and without further treatment coupled to Zinc and placed in Sea water
9:00 a.m. 2-20-17

5:00 P.M - 2-22-17 (56 hours) good coatings took out 51a washed + hung up to dry
Replaced in Sea water alone 5:00 P.M. 2-23-17
5:00 P.M. 2-24-17 rusted along edges left in water.

51b 5:00 P.M 2-24-17 altho coupled to Zinc had rusted along top edge
10:00 a.m - 2-26 top edge cleaned up a little rust on bottom

51a 10.00 a.m Rusted a little more along edges Put the Zinc back in the water without disturbing rust
3:30 P.M 3-12 51a about the same 51b rust on top edge took out rinsed and hung up to dry
Took 51a out rinsed washed in weak HCl - and given new number
8:30 a.m 3-13-17 51b drying since yesterday afternoon replaced without Zn.

⊕

#52 Steel from Cap 12 (polished blocks)
Placed in water without Zn 9:30 a.m. 2-21-17
9:00 a.m - 2-22 rusted on top edge.
5:P.M - 2-22 cleaned top and replaced with Zn
5:00 P.M - 2-24 Took Zn out but altho no change left steel in water.
10:00 a.m - 2-26-17 - (53 hrs) rusted on top altho Zinc in good condition
9:00 a.m - 3-8-17 (10 day 239 hrs) Rusted on top specimen of rust showing on body of plates Took out

51b continued from previous page.
8:30 a.m. 3-13-17 placed
8:30 " 3-14 rust starting on top

53 a & b

Following Numbers refer to paint for dock etc:

#53-a. piece of rough rusty steel painted with a lining which paint (red) about 2-22-17

53-b piece of rough rusty steel painted with a mixture of fairly coarse zinc dust in Boiled oil & dryer & turpe. which thin.

both a & b placed in sea water 9:30 P.M. 2-26-17

White paint rusty in 1 day (24 hrs) Zn painted plate rusted in 3 days (72 hrs)

Took out all together 8:30 a.m 3-12-17

White paint badly rusted all over.

Zn painted plate rusted but not so badly.

Painted again 53a 1:00 P.M. after burning dry:

Painted 53 b after running in top water & burning thoroughly

53a & 53b immersed in pail. 9:00 a.m 3-13-17

10:00 P.M. 3-13- 13 hrs 53a shows some rust streaks along edges.

July. 6-1917 Rust streaks along edges although O.K. 53-b in better condition than 53-a.

54. a-b & c Pieces from the same sheet of rough rusty steel painted 3:0 P.M 2-27 with the same thick mixture boiled oil dryer & turpe and the primer & medium frame filler tube.

(a) As is rusty & rough

(b) Rust smartly removed with emery paper

(c) scraped with emery paper and dipped in boiling H_2SO_4 then boiled in caustic.

(d) Small polished plate dipped in paint.

(a) (b) + (c) placed 8:30 a.m. 2-28-17 (d) 3:00 P.M. 3-1-17

Took out all together 8:30 a.m 3-12-17

a rusted along edges.

b rusted along edges worse than a.

c rusted along edges about the same as b

d rusted but not as bad as the others.

Painted again 3:30 P.M. 3-12-17 after running and burning in top water then drying

#55 Polished plate coupled to Zn in $ZnCl_2$ soln. sea Water.
To be submerged in sea water continuously

#56 Polished plate coupled to Zn in $ZnCl_2$ soln of Sea water.
To be ½ submerged continuously

#57 Polished plate coupled to Zn in $ZnCl_2$ soln of Sea Water
To be completely submerged in Sea Water.
48 hr without Zn, 24 hr with Zn.

#58 Polished plate coupled to Zn in $ZnCl_2$ soln of Sea Water
To be ½ submerged in Sea Water 48 hr without Zn and completely submerged 24 hr with Zn

#59, 60, 61, & 62 same treatment as 55, 56, 57, 58, except to be dipped in HCl first before the $ZnCl_2$ Soln.

Tank 12 Started 11:00 a.m. 3-10-17 with #55 + 59 which have been dried 48 hr coupled to Zinc in $ZnCl_2$ soln in Sea Water after washing under tap.

	#55	HCl. #59
11:00 a.m 3-10-17	front	back.
12:00 noon 3-11-17 25 hr	badly rusted on lower and sides washed in HCl + put in $ZnCl_2$ soln	slightly rusted
12:45 P. 3-13-17	in front	in back
8:30 P 3-13 4 hr	rust starting on upper edge and around wire.	Rust starting along side edges.
8:40 P.M. 3-13	rinsed in HCl + scrubbed with brush replaced with Zinc	
3-27-11:30 a.m	rusted with Zinc taken out today.	O.K. taken out today. replaced alone.
3-27- 5 P.M		

Rack # 13 Started 11:00 a.m. 3-10-17
with # 57 + # 61 48 hr completed to Zn
in Zn Cl2 soln in Sea Water and are to be
completely submerged alone 48 hr then submerged
24 hr completed to Zn.

	#57	HCl # 61
11:00 a.m 2-10-17	front	back.
12:00 n 2-11-17 25 hr	Rusted on top & in a streak down one side	Rusted much worse than 57.
	Rack cont washed in HCl to remove rust and replaced in Zn Cl2 Soln.	
1:00 P.M. 3-14-17	placed front	placed back.
8:00 a.m 3-15-17	O.K.	Rusting on lower front. cleaned in HCl & replaced with 7 min after 2 min in HCl
8:30 a.m 3-16-17	OK except where wire joins	

Rack # 14 Started a.m. 3-12-17
with # 56 + # 60 which have been
completely to Zn in Zn Cl2 Soln of Sea water 48 hr
and are to be continuously ½ submerged alone

	# 56 longpiece	HCl # 60
8:30 a.m. 3-12-17	front	back-
2:30 P.m 3-12-17 6 hr	rusting	rusting only slightly worse
	Rack cont washed in HCl to remove rust and immersed in Zn Cl2 soln.	
4:15 P.M. 3-14-17	placed front	placed back-
8:00 a.m 3-15-17	Rusting Washed in HCl	Rusting Washed in HCl
	Put in Zn Cl2 compared to Zn.	
8:00 27-17 to 10:00 a.m	Piece of polished steel of same dimensions with a film of 50% fibrolaturol 50% pure Zinc chloride waterfall of rust at start	dipped in HCl then a mixt of 50%
7-6-17		

C717

Tank 13 Started Am 3-12-17
with #58 & #62 which have been
coupled to Zn in ZnCl2 Soln of Sea Water 48 hrs
and are to be ½ immersed 48 hrs or longer than
24 hrs. ½ immersed coupled to Zn

	#58	HCl #62
8:30 a.m 3-12-17	front	back.
2:30 P.m 3-12-17 When	rusting	rusting
	Took out washed in HCl soln & immersed in ZnCl2 Soln	
8:30 a.m 3-16	out of ZnCl2	out of ZnCl2
~~1:30 P.m 3-27~~		
Am 7-6	Both rusted at edges otherwise O.K.	

The results of Nos 59, 57 + 61 at the end of 24 hours are not very encouraging for the plain polished steel with a 48 hour treatment in ZnCl2 Sea Water. The acid treated steel was dipped in NaOH soln & washed before treatment with ZnCl2 Sea water. One of the acid treatments is not so bad #59.
55, 57 + 61 (+59) were washed in HCl & immersed and immersed immediately in ZnCl2 Soln at 1:00 P.m. 3-12-17
~~55 + 59~~ taken out Noon Thursday
57 + 61 " " Noon Thursday
As ZnCl2 soln had become very cloudy & a clear soln
5:30 a.m. 3-12-17

— —

Results of 56, 55, 60 + 62 are fairly poor and show that the method of coating with ZnO in wet weight as all four rusted within 6 hrs. Took out washed in HCl & replaced in ZnCl2 soln of Sea water coupled to Zn at 1:00 P.m 3-12-17
56 + 60 taken out 3:00 P.m 3-14 Wednesday
58 + 62 " " 3:00 P.m 3-15 Thursday
56 + 58 in HCl not over 5 minutes 60 & 62 in about 25 minutes ?
8:30 a.m 3-13 ZnCl2 Soln has become very cloudy

Tanks 16 - 17 - 18

#63-64-65 Sheet steel painted with #54 paint ~~Bam~~. 3-11-17 11:00 P.M.
63 + 64 Smoothed up a bit with Emery paper
65 Cleaned in weak H Cl for 36 hrs.
#63 in tank 16 3:15 P.M 3-12-17
#64 in tank 17 3:15" - 3-12-17
#65 in tank 18 3:15" - 3-12-17
} Paint not completely hardened
8:30 a.m. 3-13 (17 hrs) rusting slightly on edges 63 but condition 64 not 65 worst 9:30 out to dry and some worst spots touched up. Painted spots and back in water 11:00 a.m.

3-16-17 - 9:00 a.m. 64 OK - 63 + 65 rusting slightly

3-21-17 8:30 a.m rusting a little out to edge. 17 best 16 second - 18 third

July 6-1917 Buried negs

Tank 22

66-67-68 3-12-17 soaked for 1 hour in dil HCl - rinsed in water and placed in Sea Water compared to Zinc - Not scrubbed only rubbed with hand
#66. Tank 12 rough steel 4:45 P.M 3-12-17
67 Tank 14 good polish " 4:45 P.M 3-12-17
68 Tank 15 good polish " 4:45 P.M 3-12-17
8:30 a.m. 3-13 66 clear 67 clear. 68 no water slightly rusty Bubbles of gas on steel
#66 changed over into tank 14 about 11:00 a.m by 1:00 P.M water becoming reddish colored - bubbles of gas continue to form on #68 took out and rinsed in HCl for five minutes and replaced
#68 Bubbles of gas still rising 8:30 a.m 3-14 but no bubbles on side of tank as there are in tank 14
4:55 P.M. 3-14 found #67 rusting tho compared to Zn. Took it out scrubbed off in fresh water and tightened the loose connection to the Zn. Replaced connected to Zn 4:30 P.M 3-14-17
#66 rusting in very small spots on top cleaned + tightened connection the same way
#68 Taken out and allowed to dry replaced in Tank 22 clean 4:50 P.M 3-14
67 Rusting badly 8:30 a.m 3-13 - Took out and left in water pail
68 Rusting badly 8:30 a.m 3-13 took out and left in water pail at head side

(75)

54a. b. & c. (vide ante)

54 a - Panel 19 immersed 9:00 a.m. 3-13-17
54 b " 20 " " 3-13-17
54 c " 21 " " 3-13-17

3-16-17 9:00 a.m.
54 a - rusting in one spot at edge at air - water contact
54 b rusting in several spots on edges under water
54 c Rusting in several spots on edges under water.

3-21 - 8:30 a.m. Rusting in spots out to edge.
19 first, 20 second, 21 third

Panel 16
contains #63. Piece of sheet steel smoothed up a bit with emery paper and painted with 2 coats of paint #54 3-11-17 11:00 P.M.
immersed in sea water 3:15 P.M. - 3-12-17
paint not completely dry
3-13 - 8:30 a.m. rusting slightly on edges
9:30 " cut to edge painted spots and
11:00 " replaced
3-16. 9:00 a.m. O.K. except several spots on one edge -
3-21 8:30 a.m. OK except several spots on both edges takes about 1/4 hr spots painted & replaced

7-6-17 Neg Wanted

Tank 17

#64. Piece of Shot Steel smoothed off a bit with emery paper and painted with Zn oil paint. 11:00 P.M. 3-11-17

3-12-17.	3:15 P.M	immersed
3-13-17	8:30 A.M	Rusting same on edges
	9:30 "	Cut to dry and paint spots
	11:00 "	Replaced
3-16-17	9:00 A.M	O.K.
3-21-17	8:30 A.M	O.K. except for pinhole spot on edge taken out dried 3/4 hr + spot painted then replaced

7-6-17 Rusted n.g

Tank 18

#65 Piece of Shot steel left in H Cl (weak) for 36 hours and painted with Zn oil paint. 11:00 P.M. 3-11-17

3-12-17	3:15 P.M	immersed
3-13-17	8:30 A.M	Rusting same on edges
	9:30 "	Cut to dry and paint spots
	11:00 "	Replaced
3-16-17	9:00 "	Rusting same on edges also at air water contact
3-21-17	8:30	Several rust spots on edges particularly at water line - dried + repainted like the others

7-6-17 Rusted. n.g

Tank 19 Piece of rusty cold rolled steel painted 3:30 P.M. 27 with #54 paint that is Zinc oil paint.
Metal rusty & rough.

2-28-17 8:30 a.m immersed
3-12-17 8:30 a.m rusting along edges removed washed and brushed dried & repainted entirely
3-13-17 9:00 a.m immersed
3-16-17 9:00 a.m. Rusting in one spot on edge at water line
3-21-17 8:30 a.m Rusting in one spot on edge at water line and one spot below. removed, dried 4 hrs and spots repainted

7-6-17 not so bad as 18 N.G.

Tank 20 Piece of same material as Tank 19
Rust mostly removed with emery paper. then painted with Zinc-Oil.

2-28-17 8:30 a.m immersed
3-12-17 8:30 a.m rusting along edges more than #19 removed washed and repainted as #19
3-13-17 9:00 a.m immersed
3-16-17 9:00 a.m Rusting in several spots on edges under water.
3-21-17 8:30 a.m Rusting in several spots on edges & flat surface removed dried 1 hr and spots repainted
3-27-17 Rusting badly in the same spots took out today 9:00 a.m.

7-6-17 Rusted N.G.

Tank 21 Piece of the same metal as tank #19. rubbed with Emery paper then washed in ~~Dech~~ H_2SO_4 + hot NaOH

2-28-17 - 8.30 a.m. immersed

3-12-17 8.30 a.m. rusting along edges same as # 20 immersed washed + reported as # 19

3-13-17 9:00 a.m. immersed

3-16-17 9:00 a.m. Rusting in several spots on edges under water

3-21-17 8.30 a.m. Rusting in several spots on edges below water line immersed dried 1 brand spots ~~[illegible]~~ repainted.

3-27-17 Rusting on edges took out 9:00 a.m.

7-6-17 Rusted and paint buckled all over

#5049

2-20-17

2-19-17 Wanted some kind of a respirator that will protect the men in the fight against the Modern Bacteriologist from the SO_2 fumes from the furnace.

Went looking for Oxidizing agents

(1) Iodine in KI.

(2) Solution of $KMnO_4 + Na_2CO_3$ or a fresh of the H_2SO_4 formed must be taken care of.
$2KMnO_4 + 5SO_2 + 2H_2O = K_2SO_4 + 2MnSO_4 + 2H_2SO_4$

(3) Sodium Sulfite Na_2SO_3 is formed by the action on Na_2CO_3 solu with SO_2 CO_2 is formed. If NaOH is used no CO_2 is formed. It is a strong reducing agent. Fumes of manganese will prevent the reducing action on organic material.

(4) Calcium Sulfite $CaSO_3$ + Bisulfite $Ca(SO_3H)_2$ Milk of lime absorbs SO_2 forming incal. salt.

#5049

2-20-17

5 Potassium Sulfide Mg. requires heat for its formation

6 Metallic peroxide

(6) Sodium peroxide too active liberates O_2 with water also NaOH which with the SO_2 would form Na_2SO_3. A little CCl_4 mixed with the Na_2O_2 is said to prevent it decomposing when added to water. (Find it Mg)

7 Sodium Perborate $Na_2B_4O_8 + 10H_2O$

8 Calcium Peroxide ~~CaO_2~~ made by mixing H_2O_2 with lime water or by Na_2O_2 + a calcium salt.
Tried in water translucent to filter does not appear to act well, when tried

9 Magnesium hydrate

10 Gelatinous Aluminum hydrate

11 Lead Peroxide. (Mg)

#5049

2-21-17

A mixture of Na_2CO_3 + Na_2O_2 seemed to be a good possibility. Then the CO_2 formed together with that already present would be absorbed by the Na_2O_2 with the evolution of O_2

$Na_2CO_3 + SO_2 = Na_2SO_3 + CO_2$
$106 + 64 = 126 + 44$
$Na_2O_2 + CO_2 = Na_2CO_3 + O$
$78 + 44 = 106 + 16$

$64 \div 106 = 0.6$ = wt of SO_2 that 1g of Na_2CO_3 will absorb.

$44 \div 78 = 0.56$ = wt of CO_2 that 1g of Na_2O_2 will absorb

A solution of the above mixture effectively stopped SO_2 when a respirator sponge was soaked in it.

2-21-17 #5049

A man breathes about 16-17 times per minute. Volume taken into the lungs on each breath probably around 240 cu in or 72 liters per minute × 60
4320 liters per hour = 0.152 cu ft per shift
say 17280 liters = 610 cu ft.

The gases in question contain about CO_2 10%
SO_2 0.5% max

∴ 17280 liters 10% 1728 liters @ 1.97 = 3456 g CO_2
" " " 0.5% 87 liters @ 2.67 = 235 g SO_2

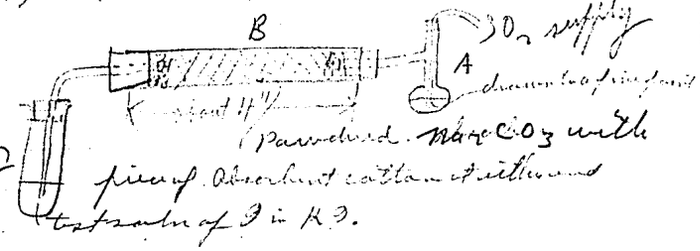
235 g SO_2 will liberate 162 g CO_2
3456 + 162 = 3618 g CO_2 to take care of

3618 ÷ 0.56 = 6456 grams Na_2CO_3 required for CO_2
235 ÷ 0.6 = 392 grams Na_2CO_3 required for SO_2
6848 grams of Soda Ash

allow at rate of 1½ cu ft per min 90 per hr
= 360 per four hr shift or 400 cu ft
= 11327 liters
See page over

2-21-17 #5049

In order to take care of the large mass of people need it is thought better to use the material in solid form.
Weather dry Na_2CO_3 will absorb the SO_2 in the gases in enclosure.
Rigged up an apparatus as below



Started gas going thru @ 120 bubbles per min at 11:17 P.M.
11.23 stopped bubbling thru B
11.43 started SO_2 entering 2-6 bubbles per ~~minute~~ minute from C with bottle in & counting the fast to count
8:[illegible] A.M. 2-22-17 Bubbles going thru slowly 6 per minute thru apparently bubbling that way all night. Gently shaking the absorbent
A lot of Na_2CO_3 still left.
It is evident that moisture will have to be carried along as the dry powder Na_2CO_3 does not seem to absorb beyond a certain amount.

5049

400 cu ft per man per shift =
11330 liter

10% of 11330 = 1133 @ 1.97 = 2232 g CO_2
10% of 11330 = 567 @ 2.67 = 151.4 g SO_2

151.4 SO_2 will liberate 102.5 g CO_2
2232 + 103 = 2335 g CO_2 to take care of

2335 ÷ 0.56 = 4170 g Na_2O_2 for total CO_2
151.4 ÷ 0.6 = 252 g Na_2CO_3 for total SO_2

4170 ÷ 2.8 = 1490 cc volume of Na_2O_2 required
252 ÷ 2.4 105 cc " " Na_2CO_3 "

1490/11 = 373 cc = 1042 grams 2 lbs

Mouth breathing forms recommended as preferable. Caustic Soda used.

for other see J. S. Haldane "Self contained off-forms in unfavorable atmospheres" report to the Coal Mines Committee
Trans. Inst. Min. Eng. Vol. p. 56 - 1914
IP 725-776 vol 48 pp 550-595

5049

Consumption of Oxygen during rest 300 to 400 cc during big exertion between 2,000 & 3,000 cc per minute
Method of forced alkalis in the ordinary types alkali containing small % of H_2O of crystallization off 17% or 1 mol. to 2 mol. of NaOH. Less heat is produced than in other forms of off and the alkali is efficient to much lower % of.
General requirements
1, O supply adequate for all occasions
2. efficient absorbent of SO_2 & CO_2 should take care of CO_2 of off. Gravity Davis
3, no negative pressure or failure conveniences liable to be needed.
4. Avoidance of warmth & lightness
4.5.7. waste fuel mechanically inter

#5649

Oxygen requirements

	Oxygen per minute	respiration per minute	tidal volume	Water tidal per min
~~[illegible]~~				
sitting still	300 cc	12-18	400-700 cc	5-13
walking	500-1200 cc			
Bicycle exercise	2000 cc	-30	1500-2000	45-60
Vigorous exercise	3000	-40	2500	100

The method O absorbed [illegible] and sitting work is about 4% of the total tidal air per minute.

The blood of a normal man is usually saturated O fully when the air falls below 13% O (at sea level)

Unconsciousness occurs at 9-10%

	No of breaths per min	average volume of each breath	volume per minute	O_2 consumed per minute	CO_2 given off per minute	Respiratory Quotient (CO_2/O_2)
Resting in bed	16.8	0.457	7.7	0.237	0.197	0.829
Standing at rest	17.1	0.612	10.4	0.325	.264	.804
Walking 2 miles per hour	19.7	1.271	15.6	0.719	.662	.849
" 3 " " "	19.2	1.530	24.8	1.065	.922	.866
" 4 " " "	18.2	2.060	37.3	1.595	1.398	.877
" 4½ " " "	18.5	2.524	46.5	2.005	1.788	.891
" 5 " " "	19.5	3.145	60.9	2.543	2.386	.938

Volumes calculated for 0°C + 760 mm Hg

Increased about 7% for a room temp of 20°C

Feb 23-1917

No - 5016

Needed something to put on the lenses of range finders & spotting telescopes to prevent the spotting due to the dripping salt from spray. Experiments showed that the glycerine brought a solution that clung well on the glass that acted as a preventative.

This suggests the use of

Chloride of Lithium Nq #3

Chloride of Calcium Nq

Phosphoric Acid Nq #1

Thick glycerine Nq #4

Castor oil Nq

Magnesium Chloride

Soap.

Oxalate of ammonium chloride

To help the spots from forming it will be necessary to have something that will help sufficient water present to help the salts dissolved. Mathewson's if plain coating will evaporate too quickly something must be there to fix the water that is something

whose solution has a lower vapour tension than water.
The following data is taken from the Physical Chemistry Tables

°C	m.m.V.T.	Butyric Acid	Geo Tartaric	Benzyl Alcohol	LiCl.	$CaCl_2$	$NaCl$
0°	4.6				425 - 2.13	411.3 - 2.28	
5°	6.5						
10°	9.2						
15°	12.7						
20°	17.4 - 0.76						
25°	23.5						
30°	31.6 - 1.5	-0.76	-1.48				
35°	41.9						
40°	55.0 - 3.0	-1.5	-2.73		32.4 - 41.0	42.8 - 42.2	442 - 35.0
45°	71.5						
50°	92.2 - 5.4	-2.9			43.6 - 355.0	53.6 - 452.2	
100°	760.0				96.5 - 120.0	72.1 - 259.3	

	H_2O	H_3PO_4	Glycerine
0°	4.6	391 - 0.636	98.2 - 2.79
100°	760.0	331 - 252.7	363.5 - 2.31

#5016

2-24-17
Small atomizer used with Sea Water
#1 Third H_3PO_4 in dilute solution could not get to cover plate example.

H_2SiCl could not get to cover plate even after washing plate with $NaOH$ + H_2SO_4

#3 LiCl + dil Glycerine covered plate spray spotted of badly binder dirt ~~into~~ stick to the glycerine

#4 50% glycerine on glass washed in $NaOH$ & H_2SO_4 + Alcohol. Sprayed
The glycerine takes care of the spot all night but it also gathers all the dust + dirt floating around.
(5) On shooting glass with spray a second time hit it quite hard and dented the glycerine surface like soft mud in a rain.
10 a.m. - 2-26 Surface still dented a little. Air in lab is quite dry. Placed in a warm wet atmosphere 10 a.m.

#6 2-24-17 Conc. soln of LiCl on plate treated as in #4. Did not adhere to the glass as well. When sprayed the spray broke up the film of LiCl leaving a lot of the glass clear. Surface tension is too high (?) Probably the addition of a small amt of glycerine will help matters.

7. Tried this and found this same result as in No 3 except in when sprayed a smooth surface was obtained. N.G.

#8 2-24-17 Conc soln of H_3PO_4 made by allowing P_2O_5 to remain in a moist atmosphere until liquified. Plate cleaned as before. Soln wet the glass very well. Sprayed during the afternoon. H_3PO_4 took care of it very well. A little later sprayed again this time spotting the surface as in #4. Placed in a damp atmos. 17:00 o'clock. Did not seem to help. When the H_3PO_4 had been struck by particles spray there appeared small bubbles evidently due to the action of the H_3PO_4 on salt present.

#9 Castor Oil does not clear up. 2-26-17

Mr Hooten from Columbia University in afternoon 2-26-17 to appraise this film.

Repeating #6 with thick glycerine.

" Feb 27-1917

#10 Glycerine doesn't work. The salts will not crystallize in it, but it is too slow + uncertain in its action. It makes a coat on the plate which is uneven + optically bad.

#2. Phosphoric acid acts quickly + well for a long time but it too disturbs the optical properties of the glass.

#3 Calcium chloride is bad, it causes the spray to collect in globules.

#3. With the idea of using a roll of film in front of the lens we stuffed a roll of Kodak film + I tested its absorption. The light lost 0.4 of its intensity in passing through 4 layers of the film. This makes a loss of about 12% of light in the first single thickness. The film is smooth enough for optical purposes.

2-28-17

98% H_2SO_4 Mg worse than the other acids like $CaCl_2$

	thick		Light lost
M.C film	.003"	88.0	12
" "	.001"	95.8	11.2
" "	.0005"	97.7	2.3
" "	.0025"	98.5	1.5

Motion Picture film

.006	88.0	12
.001	97.5	2.5
.0005	98.2	1.8

Having some film .001" made

5049

Respirators

All of the present formed apparatus involve complete respiration from a closed system

Reasons given for thinking it impossible that any apparatus can be devised forces from more than a few minutes at a time; the impossibility of carrying sufficient air to enable breathing unnecessary

great amt of heat produced when Oxygen is liberated from Na_2O_2 by H_2O vapor or CO_2

the foaming of the material and the fact that Na_2O_2 in presence of the catalyst is efficient

400-600 cc CO sufficient to cause collapse

Hartshorn's life always hint to have an inspiration pressure (1.5 cm of water) to forward gas in breathing bag system

CWJ

Mar 1-2-1917

Fluoride lots

11 Sod. Silica Fluoride P.S. leaves opaque film
12 Lithium Fluoride P.S. (partly sol)
13 Zn Fluoride #1 P.S
14 Silver Fluoride P.S
15 Zinc Silico Fluoride
16 Zinc Fluoride Insol
17 Zn Fluoride #2 "
18 Pot & Amm Fluoride Sol leaves film
19 Iron Silico Fluoride P.S.
20 Iron Fluoride P.S.

A large number of separate tests numbered 2-1 to 54 made with pure glycerine & 55 to 88 made with pure H_3PO_4 dissolved in various solvents Acetone Alcohol, Alc & Ether etc & with various thicknesses of film. None were successful -

Then a series of test of various proportions of glycerine + H_3PO_4 in the various solvents Nos 89 - 132 showed slight improvement over the plain material.

If the film is too rough it does not wear but by the spray when too thin it does not take care of

the salts. The best results were obtained with 1 cc gly. 1 cc H_3PO_4 2 Occ Alc & 15 cc Ether rubbed on a clean glass plate - (# 106)

Same thing also holds true two bodies will have to be found.

March 3d

Rain Oil

133 in glycerine Soln N. Gy.
134 in Ether soln Wipe to quickly
135 in Eth & Alc opaque
136 " " " + Gly opaque
137 " " " + H_3PO_4 opaque the gothered
138 " " " + H_3PO_4 + Glycerine Ethereal soln only small amount of Oil flowed N. Gy
139 same rubbed on wiped with Ether & then surface sprayed N. Gy.
140 Oil alone Sprayed N-Gy

141 Oil & glycerine emulsion N Gy
142 Oil H_3PO_4 + Gly " N Gy
143 Oil & H_3PO_4 does not wear N Gy
Neat foot Oil
144 Oil alone Sprayed N Gy
145 Oil + Glycerine Emul. Separates slowly Sprayed N-Gy

146 Oil + H_3PO_4 Opaque emul n-g
147 Oil + H_3PO_4 slightly Opaque emul n-g
148 Oil + P_2O_5 + Ca- flocced n-g gelatinous mass
149 " " " filtered n-g "
Hard Oil
150 Plant Oil. Emul.
151 with Plant Emul. n-g
152 with $CaCl_2$ Emul n-g
152 with Ca + H_3PO_4 Emul n-g
Light Paraffin Oil.
154 Lin
155 with glycerin Emul n-g
156 with H_3PO_4 Emul n-g
157 with glycerin + H_3PO_4
158 with P_2O_5 + Ether: P_2O_5 forms gummy ppt. mass with ether which does not seem [illegible] with hard addition of [illegible] of CaH_3O and P_2O_5 section Try ether P_2O_5 [illegible] Try [illegible]
159 Oil + P_2O_5 - No action [illegible] water [illegible] no apparent action [illegible]

#160 March 4 - 1917
Ethyl Phosphoric Acid
The Calcium acid colorless moderate viscid oil soluble liquid mixes with water in all proportions and may be concentrated by boiling at low certain pressure without decomposition. Mixes in all proportions with Alcohol & Ether. The Calcium and Potassium magnesium sodium salts are
Soluble in fair water.
The Potassium & Sodium salts are deliquescent
No information on Mg salts.
1 pt 95% Alcohol & 1 pt syrup ortho or pyro-phosphoric acid mixed at saturation 60-80° stirred 24 minutes & Tinctured hot filtered and mixed with Barium hydrate. Precipitate is granular and compact [illegible] to 70° filtered and the filtrate [illegible] cold filtrate [illegible] of Ba [illegible] Nothing [illegible] found to be a [illegible] and $BaCO_3$ filtered and [illegible] boiling [illegible] white ppt separates. Continue boiling

5016

5016

161 March 5 - 1917
Filter [illegible] added
discharged [illegible] P.O. in Albuquerque last
night. Water running over [illegible]
in 2 fountains. Sand and gravel
as of on March 161 (3-5-17)
Tank #162 [illegible] added [illegible]
water and cleaned [illegible]
After [illegible] 163 [illegible]
filtered.
161a transmitted [illegible]
of sewer [illegible]
Dated — Added [illegible] 161a
Not completely [illegible] [illegible]
on plate 161a and added [illegible]
[illegible] 161A 161B — heated O.K.
162 Reg'd on 3-6-17
161C did not [illegible]

5016

163 March 5 1917

Glycerin Phosphoric acid

~~164~~ Glycerin 50 cc phosphoric acid (syrup)

Heated on water bath stood a while

then heated over flame up to 120°C.

Put 50 cc in bottle labeled

163 (3-5-17 M) 1.30 P.M.

To this 50 cc. (# 164) alcohol

50 cc Ethyl Phosphate and heated to

60-50°C for 20 minutes set aside

163a to a little in a test tube added with warmth

no immediate result no result on standing

a few minutes. Heat & no effect added

Methanol to test part 163c

163b Powder put on glass plate

163bc solution nearly complete heated complete

164 3-6-17 Smell like brandy. Heated on water

bath for 15 min to 60-70°C

163c not completely clear probably due to dirt

Start Another batch of 164a

50 cc Glycerin 50 cc Phosphoric acid

syrup Heated on water bath 20 min

20' the mouse flame up to 120°C in

10' and allowed to cool to 67°C in

30' minutes Added 100 cc Ethyl ~~Alc~~

Alcohol. (see off page)

5016

165 March 5 1917

Ethyl Phosphoric Acid

50 cc Phosphoric (syrup) 50 cc Alcohol

heated on water bath 60-50°C

stood a little then added 100 cc

more Ethyl Alcohol heated again

and left. Cooled to 60°C and placed in

formaldehyde bottle & left off,

which has not been shaken yet 3-6-17

Placed on water bath heated for

a couple of hours ~~off~~ at 70°

(see 13 pages further on.

3-5-17 5016

166 Diamyl Phosphoric Acid
Oily liquid of sp. gr. 1.025 @ 20° floating
in half water 94% nearly inodorous
Nearly insol. in water but dissolves
readily in alcohol & in ether.
When boiled with water & yields
bromide, alcohol and the residual
liquid probably contains the
mono amyl phosphoric acid
strong acid.
Prepared by add. of $POCl_3$ to 1½
lb. of Amyl Alcohol taking care
to cool. Thermometer fluctuates
Heated for 4 hrs. Amyl Chloride + HCl
then treated with a sat. soln. of
Na_2CO_3 and shaken with ether after
removing the ether & distilling
off the Diamyl phosphoric
acid is precipitated by acidifying HCl
treated as formed compound
additional molecule of H_2O which
may be removed by drying over
H_2SO_4 in vacuo.

5016

167 March 5-1917.
Na Cl insol. to be decomposed by shaking
of lead oxide & filtered in soln.

Pure glycerine dissolved small amt. of Pure
Mn iodide, added some sat. salt to prevent
effect added some Phosphoric acid shook
well so many bubbles disappeared
heated a few minutes longer both
and set aside to settle, to a portion
167a added some NH_4NO_3 heated to
dissolve soln. cleared up cooled
167 ~~a~~ Poured some on plate 167 b and added
a little powder 167c
167a not completely dissolved poured some on
plate 167d and added up to some crystals
167c & 167c & e after boiling full of bubbles
an clear solution but not to thin place
heated both 167c when violently shaken bottles
167c Not quite complete 167e Not quite complete

167b putty mull cleared (3-6-17)
167d putty mull cleared (3-6-17)
~~167f 50~~

~~#5016~~ 5016

168 (3-6-17) 25cc glycine 1/4 g Ammonite

169 (3-6-17) 25cc of 163 + 1/4 g Ammonite

170 (3-6-17) 25cc of 164 + 1/4 g Ammonite

#161 Di Ethyl Phosphoric acid + Phosphoric acid
#163 Glycine Phosphoric Acid
#164 Ethyl Glycine Phosphoric Acid
#168 Glycine + Ammonite
#169 Glycine Phosphoric Acid + Ammonite
#170 Ethyl Glycine Phosphoric acid + Ammonite

5016

Made the following tests 5:50 P.M. 3-6-17
Cleaned glass plates. Rubbed each with a bit of clean cheesecloth wetted in 5 minutes after wiping

#161	perfectly clear	1
#163	Pale tea tint matted	6
#164	Not so badly matted	2
#168	Matted	4
#169	Matted	5
#170	Not so badly matted	3

5:35 - (15 minutes later) rubbed each one again with it proper bit of cloth which is left upon to the laboratory. Numerical keys are median surface of plates.
11:25 P.M. Rubbed all but #161 again as before
#169 & 170 some weaker [illegible] of as gas bubbles [illegible] about 10:30 P.M. Placed a little [illegible] in a small beaker [illegible] to their to allow them to absorb moisture. #167 bubbling [illegible] very little
9:00 a.m. 3-7-17
#161 still perfectly clear
#163 matted
#167 "

5016

#168 badly Matted
#169 " "
#170 Matted
I think some of the matting is due to dirty glass. Rubbed on the last four with my finger. Sprayed all quickly 9:10–9:12

#161 small circular spots ~~like formed~~ when our spray struck like soft mud in a shower.
#163 Spots much more apparent & fewer in way spray acted from parts of plate uncovered
#164 Acted like #163 but better
#168 Acted like 163 about the same
#169 Like 163 about the same
#170 Appeared to have run of spots best of all.

#161 may be so bad due to accumulated moisture that one has not been touched since last night

Rubbed each one with the same bit of cloth previously used and allowed to stand in air all night.

5016

#161–163–164 from left the first surface 2 minutes later gave a heavy spray.

#161 Broke and ran
#163, 164, 168, 169, 170 became opaque within a couple of minutes
Without any treatment sprayed heavily again.
All were opaque within 5 minutes
used same opaline which had stood exposed to air in water glasses since 3 – Hoarfrost quantity of moisture in the bottle many series of tests should be made to show quickly a coating would allow the hydrogen
#161 [illegible] still remained stained after 5 minutes
also number of small spots which appear to be caused partly by the high surface tension of the liquid pulling away from the glass and partly by evaporation of bubbles and large bubbles puncture the liquid N.G in this concentration try it much diluted

CLISJ

5016

#163 Started appearance still present after 5 minutes. Multitude of small bubbles clinging tightly to action on the water coated plate. N.g. due to gas formation and too thick solution. May not be able to correct for the gas with this solution.

#164 Started appearance present after 5 minutes. No gas bubbles, but start developed by end of 3 minutes. N.g. gas formation and too thick solution.

#168 Started appearance of start with few bubbles. Ended 3 minutes but surface broken and fully developed. Some glare in streaks along the edges. N.g. in this connection. Author has started gassing in uncertain.

#169 Solution with Start still present into the glass also numerous fine fuchsin colored specks to show left glass. N.g. in this connection thinner.

5016

#170 - Same treatment with 169 solution on which that dye and salt are not dissolved but remain in suspension in film which by form elongated and start to disappear from the glass. Much the same as 169. Both 169 + 170 are better than 165. N.g. in this connection.

Discussion In their present concentrations I do not seem to be able to clean off the accumulated salts. I would undissolved particles remain. When there disappear the increase in saline concentration at that point causes disturbances in the operation power of the liquid in direct connection to the point of solution.

With 161 which showed no start surface before spraying the action of the spray seem to form a local increase of the surface tension with the consequent

pulling away from the plate at small points
163 + 164 are better in the order named. The samples containing Ammonium Nitrate all pulled away from the plate 170 best

For the next series of tests the the 2-4 cc of each soln that has stood in the small beaker over night about 5 cc of distilled water was added, the plates were washed - boiled in Ammonia rinsed and washed in H_2SO_4 rinsed, finally with distilled H_2O
All solved between 1:00 & 1:05 PM 3-7-17
5 minutes later
161 does not come where there is the least speck of foreign matter on glass. Optical Surface bad also

163 same O.S. bad.

164 Same only not so bad O.S. poor

168 Surface best so far same remarks where there is any foreign material
O.S. good

169 Same remarks apply here O.S. - fair

170 Same remarks apply here O.S. - fair

In every case the evidence would show that the grids are too dilute

7 Covered H (Nitrate) on a shelved glass 2:30 PM to avoid contamination due to dirt from a plate not
Either too dilute or plate not clean enough. Washed plate and used the same soln. Matted appearance for a minute then remained perfectly clear unfortunately used up all of soln. 3:20 PM (This last test on pour wash bottle in fine stream.

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After 3½ hours standing without spraying Optical surfaces of all are very bad and not usable at all. The flawed plate is just as bad as the others.

8 30 a.m. 3-8-17.
None of the surfaces are too good
Flawed plate particularly bad.
163 bad
161 poor
164 poor
168, 169, 170 the best –
Sprayed all lightly. 8:45
Same order after spraying.
busy with other matters and allowed to stand until 10 a.m.
3-12-17. All blued discs are clearly from the laboratory furnace.

3-8-17
Some of each of 161, 163, 164, 168, 169, 170 were flooded in water glass and the glass flooded in a large tray the bottom of which was covered with water

~~#530~~ 5016

Then all were covered with a layer of water and left until 10:00 a.m. 3-12-17.
All bad discs were selected. Plates were taken from layer 10:20 a.m. 3-12-17 168, 169, 170 cleared almost immediately 163, 164 spots where were there was a speck of dirt.
Sprayed heavily 10:22 bad surface all
a minute later rubbed again. situated appearance

Two lots of 164 made up, each 50 cc glycerine 50 cc Phosphoric acid syrup + 100 cc of Ethyl Alcohol
164a The glycerine + acid heated on steam bath for half an hour then heated to 120° for several minutes. Cooled to 60° c added 100 cc Alcohol and heated at 70° for a couple of hours.
164b. The glycerine + acid heated on steam bath overnight, next morning up to 120° for several minutes 100 cc Ethyl Alcohol added and mixture heated at 70° all day and greater part of next day

(21)

5049.

Respirator 3-8-17

Got some flat sponge from Hoffman and cut to shape the can will take about 5 pieces. Soak up in 3.0% Caustic.

Wt of dry sponge 72 gram

Wt of can + dry sponge 485 gram.

Made up Soln of 360 g NaOH + 1200 cc + 140 g NaOH.

500 g NaOH 1200 g H_2O 1000 g Soln contains 300 g NaOH

M.G. Mashed the sponge off the sponge by 10% soln.

(3-8-17) 8:30 P.M.

100 g above soln diluted to 300 g. 10% Soln

4 gram of dry sponge absorbed 46 grams of the liquid which does not ~~bothy~~ seem to affect it.

At this rate the entire can of sponge would hold.

4:72 = 42:X X = 75.6 g NaOH

proportion SO_2 : CO_2 1 mol : 3 0 mol or 0.5% : 10%.

(4:00 A.M. 3-8-17)

100 g above sol diluted to 200 g 1.5% Soln

6 gram dry sponge absorbed 58 gram liquid

Does not seem to affect sponge

6:72 = 7.8:X X = 93.6 g NaOH

138 Hg of SO_2 + CO_2 in above proportion will take 2480 g NaOH 1 g NaOH : 0.551 g gas

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1 gr gases : 1.8 g NaOH.

Respirator

94 g NaOH would take of.

2480 : 94 = 138 : X. X = 53 grams of gases.

Total volume air needed per min at moderate exertion 60 liters @ 1.2976 gm per liter = 77.86 g

If we suppose the air to carry 10% CO_2 + 0.5 SO_2 the amount inhaled may be a third more equivalent to 80 liters air 103.80 grams

	grams air per min	grams gases per min	grams gases per hr	g NaOH required per hr	10%	15%	minutes soda would last
60 l per min	77.86	8.18	491	884		6.0	
80 l per min	103.80	10.90	654	1177		4.5	

I do not think it probable that the gases would reach any thing like that concentration at the top.

Sponges gone to ~~Hell~~ by 9:00 a.m. 3-9-17

No good. Try dipping an iron wire gauze in melted caustic washed fine amt. on wire dipped in temp. of liquid

Next tried to first mix of 2 mol NaOH + 1 mol of H_2O. 80 g NaOH. 2 ~~8~~ cc H_2O. coats well

3-10-17

Some wire gauze was made up to fit the can 14 strips 2 7/8" X 4 1/4 wt 141 g. coated with Melted NaOH containing 20% H_2O wt 682 grams 541 gram caustic took all day to cool

Tried out morning of 3-12-17. Actually

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but air is not in contact with soda long enough to eliminate SO_2 when breathing rapidly.

Wolf is going to design new can and wire arrangement allowing for longer contact with soda.

(Sa) [illegible] in the [illegible]

5049

(125)

From here on all diffs made on a plate of glass in front of end of telescope

Took some of 164a to galvanometer room

164a-1 tried dabbing on lens N-G

" 2. tried flowing on lens N-G

" 3 tried rubbing on plate glass too thick formed ridges N-G

4 flowed on plate glass too thick formed wavy surface N-G

5 Rubbed No 4 N-G.

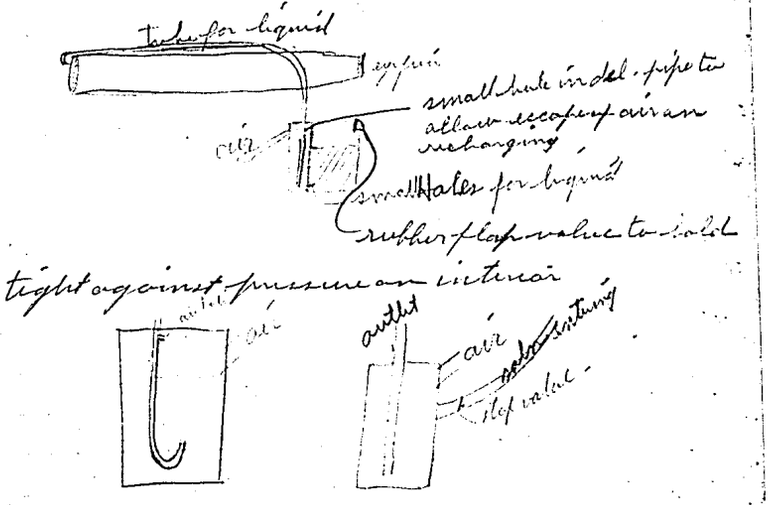
6

171 - 3-13-17 Tried the series of 162-163 164-168-169-170 which had been standing in moist air until they had absorbed a quantity of moist. All N-G either on lens or on plate in front of lens ~~[illegible]~~ Impossible to get a true surface simply by flowing the thick mat'l and then so much light is absorbed that they are worse than useless.

Have come to the conclusion that we will have to flow a liquid over the lens or plate in front of lens. This liquid must have the following properties. (a) solvent for the salts (b) solvent for grease and soot (c) either have a very low index of refraction or be chemically

and quickly volatile (d) should not be explosive or too readily inflammable and (e) be comparatively cheap.

Mechanically, if we force a definite quantity of the liquid against the lens sufficient to remove the salts by solution or by simply flowing them off and follow up the liquid with a blast of air sufficient to evaporate completely remove the liquid the result we want should be accomplished.



172 - 3-13 tried Me Alcohol rubbing N.G.
~~17~~
173 3-13 Et Alcohol rubbing N.G.

174 3-13 Propyl Alcohol rubbing N.G.

175 3-13 Amyl Alcohol rubbing N.G.

All have a film of ~~appearance~~ appearance of gum material behind
3-13-17
Built a little squirt gun and tried the following combinations.

	a	b	c	d	e	f
Ether	10	10	10	10	10	15
Alcohol	12	12	12	10	15	10
Water	15	10	5			

both by rubbing and then by ~~blowing~~ blowing on after spotting up with sea water and after putting sea water on and trying before it got dry.
With a heavy stream of air to blow the surface dry either a b or c will work if used in sufficient quantity
Effe 176 - 225 -

3-14-17.
Continuation of above work all unsuccessful

226 flowed # 164 a on glass and tried before object lens could not get a clear surface no matter how smooth it appeared to the eye
227 sprayed - took 2 minutes to come back visibility same as 226
228 sprayed 2nd time took from 2-5
229 " 3d " " minutes to clear
230 " 4th " " up so line on paper
~~and~~ could be distinguished at all

231 flowed pure glycerine on plate N.G. could scarcely see line on paper 1 hour afterwards all the surface appeared good to the eye -

232 Benzoyl Chloride rubbed on glass good surface + clear field in 1 minute visibility low, the speck early 5 to minutes became cloudy to the eye but still allowed a good visibility as before

233 Sprayed 232 and turned fan on to dry quickly even after repeating the dose No apparent difference in visibility In fact the visibility increased on repeated spraying in spite of the spatting that takes place

234 10cc Glycerin 10cc Alc - N.G when first flowed on. No better when rubbed. N.G.

235. Mona Bram Bread ~~bierge~~ caused it to form into drops which do not appear to ~~effect~~ affect the visibility

236 sprayed and while wet rubbed with 235 - N.G. Same gluey emulsion.

237 sprayed and squirted 235 on it ~~Nothing~~ N.G. does not dissolve the salts

238. Added same alcohol to 235 and squirted N.G does not dissolve the salts

239 added same 235 to mixt. of Glycerin + Alcohol Emulsion formed. Squirted on spots N.G for visibility rubbing is no good either

240 Ethylene Chloride. Rubbed on spots N.G.

241 Squirted on N.G does not dissolve

242 - Same 240 in [illegible] squirted on N.G. Visibility

243 Rubbed 242 Visibility N.G - Rubbed more + sprayed Visi - N.G - but no worse than before spraying.

5005

Smoke Bombs

#1 15g of Black powder mixt. in a paper cartridge in tin can.
158g of lamp black packed tight

N.G. Not confined enough

#2 10g of Black powder mixt in a paper cartridge in similar tin can
158 grams of lamp black packed tight

N.G.

#3 5g of Black powder mixt in a paper cartridge in similar tin can
158 grams of lamp black packed tight

N.G.

#4 ~~40 grams of Black powder mixt. in a paper cartridge in a heavy paper cartridge 3 1/2"~~
grams lamp black

#4 about 40g black powder
3" x 2 1/2" Mill. Rest of can filled loosely with lamp black. Soldered the top on
Machine bullet & rocket. Not enough lamp black.

#5 35 grams Black Powder mixt in bottom of can. 175g of lamp black packed tightly ~~into top~~ soldered.
1-ft fuse

#6 Can with 5 ft fuse ability
3-22/50g lamp black top soldered
on.
Nly.

#7 2 oz Black powder mixture
3-21 in centrif. can g lamp blac

17

#8 30g Nitre 10g Sulphur - 2g
Meal powder.
30g of mixt + 15g Naphthalene
Smoked fine

#9 150g Nitre 50g Sulphur 8 oz
Meal Powder.

30g Mixt 20g Naphthalene
Burned fine sulphur good smoke

#10 #11 #12 #13

#10 2 oz gun powder mixt (1)
8 3/4 oz lamp black

#11 1 oz gun powder mixt (2)
8 oz lamp black

#12 20 gram gun powder in capsule tube (3)
262 g lamp black

#13 30g gun powder [illegible] (4)
260g lamp black in [illegible] gun powder

(155)

#14 10g Black powder mixt 15g
3-22 Nitrotoluene.
Could not get it to burn

#15 Waterproofed moist balls powder
3-22 [illegible] it.
[illegible] g.

16# 8 1/2 oz black powder
2 lbs 5 oz lamp black -

1/
#17 75g TNT 2 lb 7 1/2 oz lamp black
in [illegible] can

#18 100g TNT.
1065 g lamp black
- in old [illegible] gasoline

#19 150g TNT
1023g lamp black -

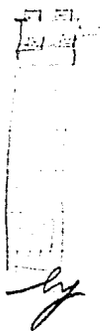
#20 200g TNT.
1010g g Lamp Black.

21. 30 g of Black Powder
3.22 & Chlorate - S. mix &
25 g of Naphthalene
Red-Brick Nap-
N.G.

#22 50 g T.N.T.
3.23 985 g Amp. Chlor -

#5049

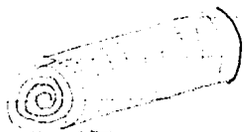
Respirator April 11-1917
New model designed by Mr
R. sketched by John Ott.



Made of Brass

Wt empty 2800 gram

Wire of 16 mesh in perforated form each 3¾" long in chamber. 3 sets



Could not get a good

4-12 & 13-17
Coating of caustic. Iron crush & the original wire probably got into the chamber.
Had best luck with the 81 + 19% caustic mixture around 130°C.
Took one length of wire had it Nickel Plated.
Also had some sections made of brass wire 28 mesh took one of these over to have it nickel plated.

wt of nickel plated 16 mesh
68 grams.

Wt of nickel plated 28 mesh
171 gram w/ with soda 337g soda 166

wt of plain 28 mesh
168

Wt of plain 28 mesh screen turned
166 grams

Wt of plain 16 mesh with soda 112g
wt alone 61 – 51g Soda

Wt of plain 16 mesh with soda 95g
wt alone 61 – 34g Soda.

New soda solution made up in ratio of 80 parts soda 20 parts water April 16th [illegible] soda.

Nickel Plate 16 mesh @ 150°C n.g.

C141

4-16-17

N. P. 28 dipped 150°-140° wt 214 soda 43 g
2nd dip 170° wt 261 Third dip 170-175 - 372 grams.
Bent copper 28 dipped 170°-165° wt 200 soda 34 g
2nd dip 170° wt 276 Third dip 170-175 Dropped on floor.

Plain copper 28 dipped rapidly 170° cooled. dipped rapidly 170-175
300g.

Holding the wire spool tightly and dipping quickly ~~gives~~ at 170°C gives a good coat. The first time a much better coat the second time and a very heavy coat the third time. Three would be sufficient.

April 19-1917

Nickel Plated 28 mesh. 385

Plain 28 mesh. 360

Plain bent Copper 28 mesh. 420

20 mesh 340 —
" " 292 first dip
" " 355

} wire 189-194

Took can & the 3-28 mesh & the 3-20 mesh over to Rohman and had a 5 hour nickel plate
Got them Tuesday Morning

5 lbs soda filling can added to 600 cc water, then 800 g soda + 200 cc water
~~Total~~ 3050 g NaOH can 5"x5"x7"
800 g H_2O
3850

April 20th

Wt of wire gauze explosions

20 mesh

Plain -	1	193 grams
1 corner clipped		187 "
2 corners clipped		190 "

28 mesh.

Plain		165 "
1 corner clipped		165 "
2 corners clipped		163 "

April 23d.

Solidification point of various strengths Kaf Caustic & water

#1 - 112 grams. 80 g Soda. - 20 g water
total wt 212 g
2 mol NaOH + 1 mol H_2O

#2 - 110 gram 75 g Soda - 25 g water
total wt 210 g.
Starts to solidify at 85° 90° Next all solid at 65°C
5.7 mol NaOH 4 mol H_2O 1.42 mol NaOH + 1 H_2O

#3 - 108 gram. 70 g Soda. 30 g water
total 208 g.
almost 1 mol NaOH + 1 mol H_2O

#4 127 gram 65 g Soda. 35 g H_2O
total 127 - 0.8 NaOH + 1 H_2O

#5. 77 g NaOH + 23 g H_2O = 1½ NaOH + H_2O

April 23d:
5 lb soda & lb water did not solidify. Spilled some. Another batch. Poured 1½ lb of water left solid fuid
53 1/2 = 100 : 50
$\frac{100 \times 100}{130}$ = 77% NaOH.

add 550 g NaOH + 275 cc of water.

Wire gauze for #1 Respirator

plain 108 gram

one corner clipped 105 gram

two corners clipped 107 gram

Boiling of Soda water noted on affinity page 194°C
Solidification point approx Thermometer 135°C
108° still liquid dipped the 3 wire for #1 Resp and one 28 mark
Temp 100°0

Wt of Respirators

	Na 1	Na 1a	Na 2
Body dry sponge valves + belt	1082	1202	1910
Breathing tube	220	220	415
3 Caustic supports	320	320	20 mark 570
			28 493
Support + caustic	497		20 1020
			28 837
Caustic	177		20 450
			28 344
Total weight			20 3345
ready for use	1799		28 3262

253.41

32.06
48
80.06

$BaSO_4 : SO_3 = 283.4 : 80.06$

$.1677 : X = 253.4 : 80.0$

.50

.0473

253.4 / 154160
11336
20800
18838
9620

Water from New Wells ~~at Boiler~~ from which it is intended to draw water for steaming purposes,

Sample rec'd Thursday May 31st

Hardness.

Soap Soln. 1cc = 1 p.p.m. 100.000 when 100cc of water is used as sample.

50cc water required 12.5cc soap soln

12.5 × 20 = 250 p.p.m. million total Hardness

100cc water boiled required 20.5cc soln.

20.5 × 10 = 205 p.p.m. million permanent Hardness. See below

500 cc sample ppd with Ba Cl2

Wt of ppt .1677g = .0473g SO_3 .25 = .00944

1,000 0.0944

SO_3 94.4 P.P.m. million

200 cc sample ppd with Ag NO_3 in presence of HNO_3

C159J

500 cc evaporated in Pitchik.

57.7000 dried on steam bath

dif 57.5000 g.

.2000

$\frac{500.2000}{5}$ = 1.000.400 ⇒ 400 pp million

57.6500

57.5000 $\frac{500.1500}{5}$ ⇒ 1.000.300 ⇒ 300 p.p.m.

.1500

Alkalinity

100 cc took 0.4 cc of H_2SO_4 soln

1 cc H_2SO_4 soln ⇒ 0.0245 g H_2SO_4

= 98 parts per million H_2SO_4 required to neutralize

Total solids should not exceed 1000 pp million otherwise trouble will be experienced in the boiler

Acidity of 50 pp million as H_2SO_4 will cause serious damage.

1 Indicated Boiler Horse Power 30 lb water evaporated per hr.

200 HP boiler = 30 × 24 × 200 = 144,000 lb

H_2O per day 1 pp million would equal.

$\frac{144,000}{1.000.000}$ = .14 lb.

Hardness. 100 cc distilled water required 1.5 cc of Soap Solution.

Total hardness then would be 25 − 1.5 = 23.5 cc

= 235 pp million

Permanent Hardness = 20.5 − 1.5 = 19 =

= 190 pp. million

5011

Primary Battery for Wireless work in aeroplane.
Want 40 volts with discharge rate of 20 milliamperes for 2 hours
Battery increase capacity by 50% -

Tried following

6-6-17

(1) copper wire coated with Ag Cl.
Conc. Zn Cl.
@ 20 m.a. - start at .68 volts max .74
End ½ hour .70 closed circuit
N. G.

6-6-17

(2) Same in 2% NH_4Cl.
@ 20 m.a. start closed circuit .79 v.
Max .85 v. 6 minutes dropped to 10 m.a.
& .20 v. 1¼ hr.
N G

6-6-17

(3) Same in 5% NH_4Cl.
@ 20 m.a. closed circuit (c.c) .69 v
Max .80 v. 12 minutes ¾ hr open circuit
(o.c.) .97 v (c.c.) .79 v. 1¼ hr (c.c.) .76 v
N G.

~~(4)~~ 6-6-17

(4) Silver wire coated with Ag Cl. in 5% NH_4Cl. At start no action, clipped end of wire exposing silver - action started immediately
20 m.a. (o.c.) .96 v (c.c) .58
19 min (o.c) .96 v. (c.c.) .78 v.
1 hr 50 min 20. m.a. (o.v) .97 v. (c.c.) .82 v.
4½ hrs 20. m.a. (o.v.) .94 v. (c.c) .76 v.
Surface of Zn changed & fresh soln of 5% NH_4Cl put in next morning
At start with 20 m.a. (o.c) .91 v (c.c) .84 v
dropped in 2 minutes to 8 m.a. .80 v on (c.c) and .82 v. on (c.c).
Will work OK.

(6-6-17)

(5) Same in 5% NH_4Cl with about 1 drop of conc Zn Cl₂ per c.c. ~~[illegible]~~
Silver wire already sticking thru the coating of Ag Cl.
Start 20 m.a. (o.c.) .76 v. (c.c) .50 v.
8 min 20 m.a. (o.c) .95 v. (c.c.) .75 v.
31 min 20. m.a (o.c) .97 v. (c.c) .78
2-31 min 20 m.a. (o.c) .96 v. (c.c.) .82½
23 hours 2 inc water off.
Pretty good.

(6) - 6-7-17
Copper wire good coating of Ag Cl
5% soln of NH_4Cl with 1 drop of
$ZnCl_2$ per c.c.
Start 20 m.a. (o.c.) .92v. (c.c.) .76v.
2 min (c.c.) .82v
8 min 20 m.a. (o.c.) .98v. (c.c.) .86v
49' max 20 m.a. (o.c.) .98½v (c.c.) .89v.
2-19 min 20 m.a. (o.c.) 97 (c.c.) 87½
looks good.

(7) 6-7-17
same 10% soln NH_4Cl + 1 drop
$ZnCl_2$ per c.c.
start - 20 m.a. (O.V.) 90v. (c.c.) .72v
2 min " (O.V.) 98v. (c.c.) .84v
8 min " (O.V.) 98½v. (c.c.) .88½v
Max 1hr-2min " (O.V.) 98½v (c.c.) .91½
2hr-12min " (O.V.) 98v (c.c.) .91
deposit formed on Zn on all the Cu wire
cells requiring the cell to be shorted
occasionally to prevent short
circuiting
2hr-40min 20 m.a. (O.V.) 89 (c.c.) .84

(8) 6-7-17
Copper + Ag Cl same as before
Zinc amalgamated both in
soln of 50% $ZnCl_2$.
Start 20 m.a. (o.c.) .88v. (c.c.) .6 2v.
Max O.V. in 16 min (O.V.) 90-.92v (c.c.) .73v.
internal resistance decreases so that
after 1hr 8min (O.V.) .88-.92 (c.c.) max .80v.
N. G.

(9) 6-7-17
two cells similar to (7) in 10% NH_4Cl
with 1 drop conc. $ZnCl_2$ per c.c. soln.
arranged in 5/8" holes in wooden block
previously soaked overnight in oil
holes soldered together in series
Start 20 m.a. (o.c.) 9.8v. (c.c.) 8.0 internal
resistance (i.r.) 90 ohms
2 min 20 m.a. (o.c.) 10.0v (c.c.) 8.8v (i.r.) 60 ohm
12 min 20 m.a. (o.c.) 10.0v (c.c.) 9.0 (i.r.) 50 ohm.
Kept at this point for at least 20 minutes
at end of 52 min from start (o.c.) dropped
to 9.2v. (c.c.) 8.6v. (i.r.) 60 ohms.
1hr-30min 20 m.a. (o.c.) .69v c.c. .62v
probably all short circuited in the
block. Zinc coated pretty well
cathode when taken out.

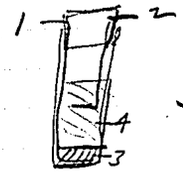
(10) - 6-8-17
Small Clark cell made up with Mercurous sulfate in place of Mercurous
Start 20 m.a. (o.c) - 1.26 c.c. .82 v
M. G.

(11)
Ag Wire + Ag Cl + large zinc, in 10% NH_4Cl with 1 drop of conc zinc chloride soln. per c.c.
Run 2-40' at 20 m.a. - 97.(o.c) & 88 (c.c)
good

(12)
Same with amalgamated Zinc in 10% NH_4Cl as in #11
very erratic

#13 25 cells similar to (11) in 1/8 tube in wooden block.
Run for 1½ hours at 20 m.a.
24.6 (o.c) 19.1 (c.c)
after that block split and shattered the cells
M.G.

#(14) June 14 - 1917
Made up a cell in a pill bottle as near the Daniell cell



1 Copper wire
2 Ag Cl packed in bottom of tube
3. Zinc Strip
4. 20% soln. of NH_4Cl.

Badly polarized in less than 10 minutes.

#15 June 14 - 1917
Same as No 14 except the copper wire was replaced by a Silver wire
Voltage o.c. Max 99 dropped to 92 end of 2 hrs
c.c. Max 83 after shaking at end of hour. .79 at end of two hrs.
Amperage 40 m.a.

#16 June 15
Same with Amalgam and Zinc
m.a. 40 May voltage
(o.c.) 1.03 at start .98 – 1.00 at end of hour. (c.c) .79 – .81
Dry cell gave out after 1 hour

#17 June 15
1 Ready cell no 706
1 Battery light contains 2 cells each 9/16 dia X 2" long 13 gram weight Price per battery 25¢ in lots of 1000 or so price 16¢
1 cell tested at 40. m.a.

		(o.c)	(c.c)
Start	40 m.a.	1.42	1.40
11'	"	1.34	1.32
28'	"	1.28 – 1.29	1.26
44'	"	1.27	1.24
1 hr 52'	"	1.12 – 1.14	1.10
2 hr 26	"	1.08	1.02

#18 June 15
5 Ready in series on soldering connection cells became quite hot

Time	Slo		o.c	c.c
	Start	40 m.a.	4.7 – 5.0	4.7
15'	15 min	@ 40 m.a.	4.8	4.5
30'	15 min	@ 20 m.a.	4.8	4.6
45'	15 min	@ 40 m.a.	4.6	4.2
60	16 min	@ 20 m.a	4.6	4.4
1 hr 16	15 min	@ 40 m.a.	4.5	4.1
1-30 m	14 min	@ 20 m.a.	4.5	4.3
1-45 m	15 min	@ 40 m.a.	4.4	4.0
2-0	15 min	@ 20 m.a.	4.4	4.2
2 15	15 min	@ 20 m.a.	4.4	4.2
2 45	30 min	@ 20 m.a	4.3	4.1

C165J

Col. King
Rock Island Arsenal